radical nature of the hydrocarbons, and to negative the assumption of their being homologues of marsh-gas.

The paper concludes with a description of a method, by which, where numerous vapour-density determinations are to be made, the necessity is avoided of refilling the balloon with water or mercury in order to determine the residual air.

II. "On the Optical Characters of certain Alkaloids associated with Quinine, and of the Sulphates of their Iodo-compounds." By WILLIAM BIRD HERAPATH, M.D., in a Letter to Professor STOKES, Sec. R.S. Communicated by Professor STOKES. Received January 8, 1857.

You will probably recollect that I sent you some time since a small portion of an alkaloid, which at that time was called quinidin in Germany, but it has since been distinguished from it and named cinchonidin. You then examined it for epipolism or fluorescence, and you pronounced the opinion that it possessed this property only in a minor degree, and you imagined that this arose from the presence of a small per-centage of $\alpha$-quinine.

I have since obtained, through the kindness of Mr. J. E. Howard, specimens of the perfectly pure alkaloids quinidin and cinchonidin, and find that quinidin, which I can now identify as the $\beta$-quinine of Von Heijningen, possesses the phenomenon of fluorescence or epipolic dispersion as powerfully as $\alpha$-quinine; whilst cinchonidin, if perfectly pure, is devoid of it altogether; and recent experiments have shown me that a small per-centage of quinidin was the cause of the epipolic dispersion found by you in the specimen of cinchonidin sent by me.

It may be as well to state that the cinchonidin tested by water of chlorine and ammonia gave no evidence of green tint, which it would have done if only $\frac{1}{5000}$dth part of either $\alpha$-quinine or quinidin had been present, according to some recent experiments of my own.

I have also found that 1 gr. of pure quinine or quinidin in 35,000 of water will give an evident "*epipolic*" appearance; whilst when diluted with 70,000 grs. of water we have still very evident appear-

ances of "fluorescence" upon the perpendicular wall of the glass vessel exposed to the incident light; whilst a bluish milkiness of "internal dispersion" may be seen when 1 gr. of either alkaloid is diluted with 700,000 grs. or 10 gallons of distilled water, well acidulated in all these cases with sulphuric acid.

Some other interesting results have followed from these investigations. When quinidin is dissolved in an excess of diluted sulphuric acid, and the solution mixed with about twice its bulk of spirit, and warmed to 130° F., and tincture of iodine then added in sufficient quantity, and subsequently set in repose, beautiful red acicular crystals are deposited; these, upon recrystallization from rectified spirit, acquire an increased size, become beautiful quadrilateral prisms, leaving a deep garnet-red by transmitted light, and possessing a clear bluish-purple reflected tint; they are optically doubly absorbent in a slight degree, and transmit a brownish-orange body-colour when polarized perpendicular to axis. The primary form appears to be a rhombic prism, and as far as my present analyses go, appears to possess centesimally the following composition:—

| | |
|---|---|
| Iodine | 39·665 |
| Sulphuric acid | 6·273 |
| Carbon | 32·890 |
| Hydrogen | 3·960 |
| Nitrogen | 4·400 |
| Oxygen | 5·040 |
| Water | 8·504 |
| | 100·712 |

The excess arises from the hydrogen twice calculated in water of crystallization.

These numbers agree very closely with the formula

$$(C^{35}\,H^{19}\,N^{2}\,O^{4}+I^{2})\,SO^{3}\,HO+5HO,$$

and prove it to be the sulphate of iodo-quinidin, very analogous to the optical quinine compound, yet differing materially in its optical properties.

There is another alkaloid frequently associated with quinidin, which also crystallizes from spirit in the prismatic form like quinidin and cinchonidin, but is another example of epipolism or fluorescence.

Its iodo-sulphate is deep olive-green in its reflected tint, orange-yellow by transmitted light, and possessing in an eminent degree optically doubly absorbent powers, thin laminæ being quite black, but still thinner ones give a bistre-brown "body-colour" when polarized perpendicular to axis.

This alkaloid was also furnished me by the kindness of Mr. Howard, but has not yet been sufficiently purified, or in the quantity necessary to give certain results.

It possesses one very peculiar property. When dissolved in chloroform and evaporated spontaneously on glass, the gummy and uncrystalline residue, mounted in Canada balsam, at once shows a deep blue-green, epipolic, or fluorescent appearance.

Pure cinchonidin does not possess epipolic dispersion and does not become green by chlorine-water and ammonia; and when it is dissolved in acetic acid or chloroform and the fluid is exposed on glass plates to spontaneous evaporation, beautiful crystals in circular spots or drusæ develope themselves, which under polarized light exhibit black crosses and white or coloured sectors.

These appearances are not exhibited by pure quinine or true quinidin ($\beta$-quinine), both of which give a gummy, uncrystalline, and perfectly transparent residue.

Pure cinchonidin, thus optically and chemically distinguishable from either quinine or quinidin, is still further remarkable for producing with sulphuric acid and iodine an optical doubly absorbent compound of intense power, even equal to the sulphate of iodo-quinine compound; these crystals are very similar in form to my artificial tourmalines, and have long been mistaken by me for them; even at present I can only distinguish them by the tints in reflected light and the complementary body-colour, viz. whilst sulphate of iodo-quinine gives a cantharidin-green reflected tint, and a pink, ruby-red, reddish-brown or black body-colour when polarized perpendicular to the axis, according to the thickness of the plate examined, the sulphate of iodo-cinchonidin is golden-green by reflected light, and gives a sky or indigo-blue or black "body-colour" when polarized perpendicular to the axis. I have not yet made sufficient chemical analyses of this substance to enable me to decide on its formula, but I have obtained 39·307 per cent. iodine and 8·864 per cent. sulphuric acid, which sufficiently indicate a chemical difference in constitution

from the sulphate of iodo-quinine, which, it may be remembered, contains 32·609 per cent. iodine and 10·61 per cent. sulphuric acid.

I hope soon to present these results in more detail when sufficient leisure is afforded me for the purpose.—W. B. H.

*January* 29, 1857.

Major-General SABINE, Treas. and V.P., in the Chair.

The following communications were read:—

I. "On the Nervous System of *Lumbricus terrestris*." By J. Lockhart Clarke, Esq., F.R.S. Received Dec. 18, 1856.

(Abstract.)

In the summer of 1855, with the view of throwing some light on other researches in human anatomy, in which he was already engaged, the author undertook some anatomical inquiries on the nervous system of Invertebrata; but finding them occupy more time than he could spare, he was compelled to relinquish the pursuit after having made many interesting but desultory observations on various animals. As he had proceeded, however, to a considerable extent with the nervous system of *Lumbricus terrestris*, and discovered in it much that is important and was hitherto unknown, he has thought it expedient to resume and complete this portion of the subject without further delay.

Before treating of the nervous system it was necessary,—in order to show the proper functions of many of its parts,—to give some account of the organs of prehension, deglutition and digestion; and as these are insufficiently explained elsewhere, the author has described them entirely from his own dissections and observation.

The first anterior segment is a conical or nipple-shaped projection inserted behind into the upper fifth of the second segment, or first ring. Its dorsal surface is covered, except in the centre, by concentric laminæ and irregular masses of pigment-granules, which are interspersed with large, peculiar and nearly pellucid cells. Its under part forms